REAL TIME POLICE VIGILANE TRACKING SYSTEM USING WEBAPP

Project Report

Submitted in fulfillment of the requirement for
the degree of Bachelor of Technology
In
Computer Science and Engineering and Information Technology

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Under the supervision of
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To

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Certificate

Candidate's Declaration

I hereby declare that the work presented in this report entitled "Real-Time Police Vigilance Tracking System" in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Computer Science and Engineering/Information Technology submitted in the department of Computer Science & Engineering and Information Technology, Jaypee University of Information Technology Waknaghat is an original record of my own work carried out over a period from July 2019 to May 2020 under the supervision of Dr. Pardeep Kumar (Associate Professor, Computer Science &Engineering Department).
The matter expressed in the report has not been submitted for the award of any other degree or diploma.

(Student Signature)

Sarthak Thakur (161292)

Atharvan Gupta (161286)

This is to certify that the above statement made by the candidate is true to the best of my knowledge.

(Supervisor Signature)
Supervisor Name: Dr. Pardeep Kumar
Designation: Associate Professor
Department name: Computer Science and Engineering and Information Technology

Date: 02/06/20

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ABSTRACT

Today the crime is increasing exponentially despite the decades of efforts by the Indian police force to put a curb on crime. What we need is a drastic change in the traditional policing methods, especially vigilance. Several countries have by now reformed their surveillance systems by integrating them with latest technologies which have been greatly helpful in reducing crime. But our country is eagerly waiting for a major change in the police. There are several reasons as to why we haven't yet experienced a paradigm change in our ancient systems which include tremendously understaffed police force, awfully expensive technologies available in the market and less reach of the internet to the masses.

During a crime scene two things are of utmost importance: First, how early the police is informed and Second, how soon the police locates the crime scene. We wish to increase the efficiency of police by adding a real time tracking system to the existing ancient police vigilance technology. We aim to provide user and the police with a simple system where user will only need to press an emergency button and the real-time location of the user will be pinpointed on the map in the web-app of nearest policeman.

Data from the United Nations Office on Drugs and Crime (UNODC) shows that in 2013, India has 138 police personnel per lakh of population. Thus, the current police force in India is highly understaffed and obviously, this delays the police arrival time and overall vigilance efficiency of Police. The Real-Time Police Vigilance Tracking System shall help the police reach the crime scene on time and therefore help reduce the crime.

CHAPTER 1: INTRODUCTION

Introduction:

A GPS tracking system in a mobile device such as an android smart phone makes use of several in build features to retrieve the location of the device and send it to another remote device. Android devices have a free and default access to the necessary services to access the geographical location of the device which, otherwise, needs to be purchased and adds to the operational costs of the system.

Let's look into some of major features of a GPS tracking system:

GPS

GPS stands for "Global Positioning System". GPS which is a satellite-oriented route framework was designed in 1973 by the Defence Branch of The United States of America. This system was formed using 'Twenty Four satellites' placed in space by the U.S. It works twenty four/ seven, regardless the weather or whatever the location on earth. In the 80's, normal citizens were granted the access to GPS by the organization, even though, originally it had been deliberated for military operations only. With an enormous budget of $12 Billion, The United States' Defence Branch with the help of an American physicist Ivan Alexander Getting developed the Global Positioning System as we know it today. It included neither subscription costs nor arrangement costs for using GPS. It's a framework for satellite-routing which has been particularly deliberated to calculate route. These features of the Global Positioning System are going to prove to be extremely useful for our system. The fact that the services it provides are fundamentally free of cost helped us develop a system which includes no operational costs and yet efficiently able to retrieve, store and share the geographical location of the stand alone android smart device.

The initial GPS system, constituted of six satellites in each of the three orbital levels dispersed to a hundred and twenty degrees, in total 18 satellites. These were separated largely among their ground stations and cover whole of the earth. GPS made use of these "artificial stars" i.e. satellites as reference

points for calculating the exact geographical location to the precision in metres. This location has been found to be very accurate and since then served several military, commercial as well as individual purposes.

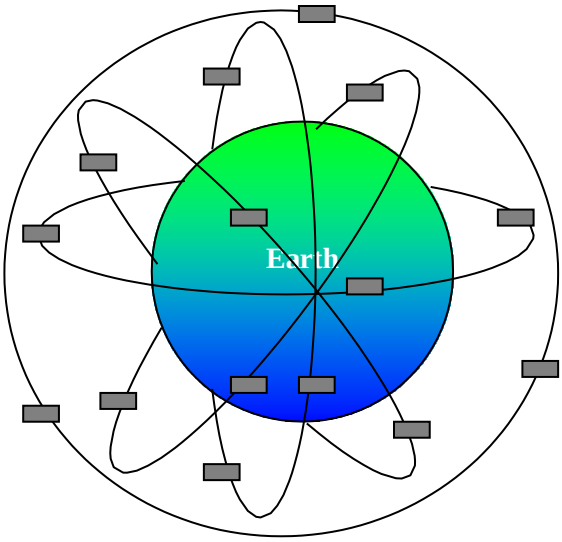

Figure 1. Satellite placement in orbitals.

It's also possible to make calculations with precision of even a cm using the GPS as it has been bettered over the years and made much more reliable. These days GPS navigation has become very common not only on mobile phones but also in automobiles including civilian as well as military vehicles. A mapping instrument like GPS has time and again proved to be useful in many ways.

Now we will discuss why getting a GPS enabled device or a stand-alone GPS integrated hand-held device is beneficial. Some of the benefits are: (i) it could help determine where we exactly are at any given instance. (ii) Also, it could tell us the name of the street that we may be heading on. (iii) The precise geographical data i.e. latitude and longitude can be retrieved using GPS.

However, these days, the Android platform is becoming more and more popular among general people as well as developers since, it uses 'Location Based Services' which simplifies the overall integration with GPS. Along these lines, this proposed framework to be specific "Constant Police Vigilance System" utilizes GPS and any cell phones having an Android working framework to follow the area of an individual at whatever point fundamental.

Location Based Services

LBSs (Location-Based Services) are model for association and customers to effectively access geological area of an object of intrigue which will either be an advanced mobile phone, tablet or PDA's. A typical case of utilizing a LBS will be to find cafés, or closest train station utilizing any of the recorded handheld gadgets. Since July 1996 when FCC (the Federal Communication Commission) gives the operational license for the arrangement of crisis remote administrations, Location Based Services has slowly become the significant focal point of versatile administrators.

Many people may think that LBS has emerged in the last few years since we have seen its increased use in recent times but it has been around since the last millennium.

In the late 20th century, 3 separate technologies united: mobile internet access, global positioning, and advanced GUI, to give birth to the Location Based Services.

Looking at the recent times, we can easily observe that the number of LBS enabled mobile devices (including mobile phones and laptops) has slowly increased in the last many years. Some examples of the systems which make use of Location Based Services are listed below:

- Uber: The world's most popular cab service which has been making use of LBS since many years now to give its users a very reliable and efficient cab booking and boarding experience. It can also calculate the route and estimated fare using LBS.
- Zomato: This food delivery and recommendation application is indigenous. It can give you suggestions about what to order and where to order from based on your geographical location.
- Pokémon Go: This is a mobile phone game which was an instant hit among teenagers. This game simulates an Augmented Reality and combines it with the LBS to give its users give of a kind experience
- Aarogya Setu: This is the most recent application developed by the Government of India for contact tracing using LBS and Bluetooth to avoid infection and to recognize infection hotspots. This application is a major breakthrough because this the first time the government has accepted the benefits of LBS for the welfare of the general public. This may open a doorway for GPS tracking system like ours which in the past couldn't make it to the masses because of egislative limitation.

Location Based Services (LBS's) are utilized significantly in getting the present and past area of clients (really items, for example, advanced mobile phones held by the client) with this data we can give data that may respond to questions such the GPS area (Longitude and Latitude), foresee the future area of that article with information mining, following back to a past area, declares that these administrations additionally include:

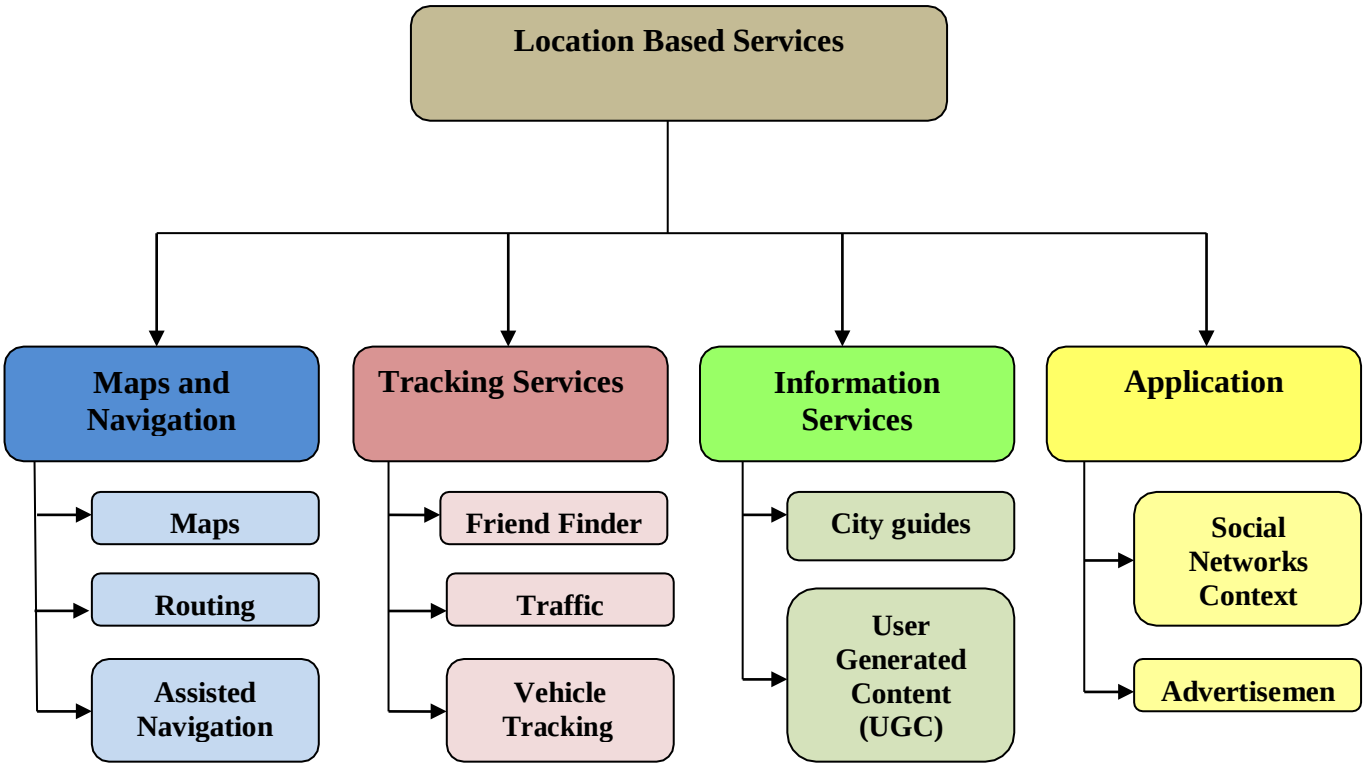

Figure 2. Benefits of LBS

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The android platform has pre-integrated Location Based Services, so we will manipulate the LBS provided using Google maps on Android smart phones which are available to use free-of-cost. The only big cost will be to get an Android based smart phone which most of the people are already using these days.

Problem Statement:

Most of the location based systems these days are a nightmare if we talk in terms of feasible and efficient usage. They are complex to interpret and to use for a layman like a postman with less knowledge of technology. Some of the difficulties we've been capable to find with the designs of current Location-Based Service are listed below:

Many of the LBS applications which have been produced don't develop very accurate and efficient result.

Security of object that is location is been track has been a big issue.

Price of the present handheld devices using LBS is another issue. These devices are very costly and maintaining them also costs them very high.

The current systems have very complex user interfaces. To understand all the features of these systems sometimes personnel have to get special training, this further increases the overhead costs.

Objectives:

The major objectives that Real Time Police Vigilance Systems will achieve are:

To develop a system that will be able to locate the geographical location of the user's device and track its current route.

To develop algorithms and functions that will enable the end user mark their previous location and trace back to that location.

To create an alert system that will notify the nearest on-duty police personnel about the potential crime.

To create an interface to Google Maps using an API which will help the policeman locate the potential victim

To create an interface with a real-time database which store the geographical location data of the users.

To Install and test the application in an Android mobile operating system.

Methodology:

(1) Firstly, the area information for example scope and longitude of the client are separated utilizing geolocation function of JavaScript. The geolocation function recovers the current geographic position of the gadget. We will store and utilize this data track the device. To get this data we will design a simple app for the user which will retrieve and store the geographical data of the user over a database.

(2) Required algorithms are designed and developed that shall be required to track the user and plot it on the map and also to help the policeman reach the victim

(3) The next step is to design and a database in which we will store this data in nodes. Then we will create a interface between the database and our system using required API. We need a dynamic real-time database for this purpose which shall be continuously available.

(4) Then the position of the user is to be plotted on a map which will be accessible by the admin i.e the policeman in real-time. This is done by designing a different application for admin in which we make an interface between our database, web-application and the Google maps by utilizing proper keys and functions. The Google Maps Platform is a set of APIs and SDKs that enables designers to embed Google Maps into portable applications and website pages, or to recover information from Google Maps.

Organization:

The chapters of the work are divided into5 chapters:

Chapter 1: Introduction

This chapter highlights the basic working of G.P.S and Location Based Services in designing a real-time GPS tracking system using a web-app/android. Also, the problem statement, objectives and methodology realized are discussed in this chapter.

Chapter 2: Literature Review

Here we discuss from the research papers in journals and platforms such as those from International Journal of Advances in Engineering & Technology (IJAET), International Journal of Computer Science Issues etc.

Chapter 3: System Development

The hardware and software specifications are described here; moreover various libraries used for the task are discussed over here.

Chapter 4: Results and Performance Analysis

The alignments of test set are covered here covering the day to day domains. We discuss here our test plan over the various parts of our system.

Chapter 5: Conclusion

The summary covered is in this chapter which depicts the use of the platform for the mentioned tasks. Here we have discussed in detail the benefits and limitations of developing a location based tracking system on a mobile device. We've also discussed the scope for futue work on this project.

CHAPTER 2: LITERATURE SURVEY

Following papers were taken into consideration:

i) **Implementation of Location Based Services in Android using GPS and Web Services [1]:**

In this article the writers structured an Android application which can discover closest address and ascertain the route between client area to a different destination. The writers have been able to efficiently utilize web services of General Packet Radio Services (GPRS) and Location Based services (LBS) on android based- cell phones to give these important results:

- educating customers regarding current traffic conditions,
- Giving Geographical location data.
- Find the shortest commute rote for the user.

In this paper, the creators have discussed and proposed that Location Based Services can be executed using two features:

- Google Web Services
- Walk score Transit API

On an android device, these featured are easily executable and can be used provide various administrations which make use of client location for providing various services.

This paper helped us understand:

- The basic concepts of Location Based Services, Google web services, different APIs and features of android devices.
- The relationship between different technologies that combine to provide the user a seamless GPS based tracking services.
- Also helped us to establish the relation between these technologies and their individual applications.

ii) GPS-based Location Tracking System via Android Device [2]

Here, the writer wishes to make more and more people used to the recent technologies related to location tracking. The main objective of this research is to develop a location tracking system for general users on an android platform. The writer expected to create system that will be helpful to manage a group of people on a trip. In situations like this, it's hard to organise all the participants'. Also at moments it may seem like it's impossible to limit the movement of the participants. Here, such a system can be very helpful to manage the people by tracking those using GPS. This way a lot of time can be saved and instances of people getting lost can be avoided.

The creators have made use of JAVA language. For a web server to maintain the database the creators have used MySQL, PHP and Python . The creators have divided the system in two sections:

(i) admin and (ii) user. Then they discuss the system requirements for both the sections in detail. Some other languages and tech used in designing the system include:

- P H P
- C S S
- XML
- Java Script
- Jason
- DB Queries Language

As we have already seen GPS gadgets' exorbitant prices the creator wished to use android cell phone instead of hand held gadgets. The creator used these devices since all smart-phones these days have integrated LBS. The geographical data of the user will be retrieved by GPS. This data will keep on updating at particular intervals based on few circumstances. Based on the location data, it will be plotted on the map and when it updates, it will be plotted again. Simultaneously, through an interface this data will be sent and stored on a web-server which is a limited-access region using different nodes. To access this limited-access region i.e the web-server, Username and password will be required.

Further the creator discusses some limitations of this system which are mentioned below:

- Constant need for GPS
- This will drain the battery of the device faster. Reliability reduces since the battery may die any moment.
- Fast internet connection required at all times.

iii) The Emerging Ethics of Human-centric GPS Tracking and Monitoring: [3]

The perpetual scaling down of the GPS chipset implies that this technology can be put in all kind of devices including wrist watches/bands, smart phones etc. What's worrisome is that this technology can locate the geographical location of any user with the precision of centimeters. This research paper focuses on establishing the moral apprehensions related to increasing GPS uses among general citizens by examining the essence of this technology. The major concerns over the generalized GPS applications are:

- Personal Security of the User
- Privacy Breach issues
- No clear legislation highlighting the guidelines for using this tech
- No specified limits and extent the capacity of such a broad technology.

The authors look in each aspect relating to GPS services as mentioned above in detail thereby listing the pros and cons. Also they discuss the potential ways to overcome the existing issues in such systems. They believe that each organization using the geographical data of the user is obligated to introspect and find ways to secure their clients.

The result of the exploration by the writers is that the integration of the GPS based services in various fields such as:

- Control (tracking/surveillance)
- Accommodation
- Care (health/general)

The administrations need to establish basic ethical systems which are sensitive to the security and privacy of the users. For this some points that need to be kept in mind by different organizations are:

- Protection
- Property
- Precision
- Availability

These new mechanical applications give cops a wide assortment of investigative capacities and asset the board data. GPS/GIS will enable them to coordinate assets in a way that is both adaptable and receptive to the dynamic and unstable nature of open wellbeing activities.
GPS innovation, when joined with mechanized remote portable field information gathering, speaks to the way that law authorization organizations will take into the future for records and asset the board. GPS information, installed in the DBMS, will give the ongoing theme that ties the embroidered artwork of current law implementation business process.
This research paper proved helpful for us to understand the fundamental ethics related to GPS tracking and monitoring of a user. We learnt that if we use such a technology then it must be only for the welfare of the people and not for personal gains.

iv) GPS SYSTEMS LITERATURE: INACCURACY FACTORS AND EFFECTIVE SOLUTIONS:[4]

Today, GPS is very much broadly used in various applications but the main issue that customers face with these GPS systems is the inaccuracy and inefficient. This research paper focus on studies into different factors which are resulting in errors and inaccuracy in the existing GPS systems. Some of these factors are:

- Ionospheric effects
- Shifts in the satellite orbits
- Clock errors of the satellites' clocks
- Multipath effect
- Tropospheric effect
- Calculation and rounding errors

Though if we look at each of these factors individually, these factors are very and mostly have very minute effects on the precise location. But sometimes one or more of these factors may combine together to give anomalous results. In systems where we require greater significance of the data collected we need to make sure that these factors don't compromise the data and may not cause errors which may result in faults and even system failure.

In our system, we need to keep these factors in mind while establishing the reliability of our system because ours is a system where a system failure can prove to very dangerous and even fatal. It's true that over the years GPS systems have achieved a great amount of precision with various technological advancements but still these systems are not 100% reliable.

In the below are the readings of the error values which may be generated by each of the above mentioned factors that the author observed:

Effect	Error Values
Ionospheric effects	± 5 meters
Shifts in the satellite orbits	±2.5 meters
Clock errors of the satellites' clocks	± 2 meters
Multipath effect	± 1 meters
Tropospheric effect	± 0.5 meters
Calculation and rounding errors	± 1 meters

Table 1. Factors related to error rates [14]

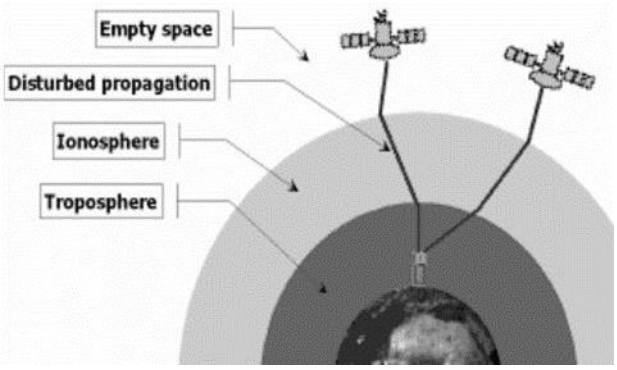

Figure 3. Ionosphere and Troposphere Regions [15]

The author suggests various ways to improve the accuracy of the GPS system e.g. Reference station networks, perceptive GPS, software algorithms etc.

Some of these factors like ionospheric effects, tropospheric effects, shifts in satellite orbital and clock errors are inevitable. We can't control most of these. Satellite efficiencies can only be done over time. But this doen't mean that we have to overlook the possibility of them causing errors. What we need to make sure that we design a system which is fault tolerant and even in the scenario of these factors giving anomalous data our system doesn't experience a failure.

v) Research on Google Map Algorithm and Implementation: [5]

This paper presents:

- the head,
- calculation and
- usage of Google Map,

likewise a few tests produced by the demo framework are given. It can give references to the joining of Geographic Information System (GIS) applications. Google gives relating API to clients to coordinated guide work into their very own framework. The creator talks about the Mathematical model of Google Maps. Likewise, different projection models like:

- Mercator Projection
- Google maps projection

Which are clarified which layout the structuring of Google maps.
This paper helped us understand how Google maps uses the data collected through satellites and then process it so that it can be used to design a whole map which covers almost all of the earth using various algorithms which are called Google maps mapping algorithm.
Further, Google maps has provided various functions with the help of which various users can implement the Google maps and it's various features in their own systems. We will be implementing many of these functions provided in the directory of Google. We will be doing this after we are able to create an interface to Google maps with our system using the Google maps API.
Conclusion of this paper is that Google uses a very sophistically developed algorithms i.e. Google maps algorithm to design its maps as we know it. Many features of the Google maps can also be edited using Google functions in android.

vi) Role of Global Positioning System (GPS) in policing: [6]

With GPS/GIS, the cutting edge law authorization organization presently has another variety of devices for battling wrongdoing and overseeing traffic.

These new mechanical applications give cops a wide assortment of investigative capacities and asset the board data. GPS/GIS will enable them to coordinate assets in a way that is both adaptable and receptive to the dynamic and unstable nature of open wellbeing activities. GPS innovation, when joined with mechanized remote portable field information gathering, speaks to the way that law authorization organizations will take into the future for records and asset the board.

GPS information, installed in the DBMS, will give the ongoing theme that ties the embroidered artwork of current law implementation business process.

Some major applications of GPS in the police are:

- Controlling traffic: Using GPS applications the traffic police can establish traffic movement patterns. At places where traffic is more or is tending to increase, the police can take preventive measures.
- Surveillance of suspects: Some dangerous suspects or convicts who maybe out on bail or parole could be easily tracked using GPS to avoid crime. This could significantly help police to avoid instances of evidence tampering, crimes against witnesses, violation of parole.
- Vigilance and Patrolling: Tracking the people in need for police help can be done efficiently using GPS applications such as navigation. This application of GPS can help police put a curb on increasing crime. Many instances of crimes can be avoided since GPS will help the police reach the victim in time.
- Preventing riots: In situations of communal tensions or extreme social anger when chances of violence are very high, Police may use GPS to identify places where large number of people are converging and take appropriate preventive measures. This way huge riots which may end up taking many lives can certainly be prevented.

- Preventing robbery: Since most vehicles and smart phones these days come with in-built GPS systems. In case a vehicle or a Smartphone gets stolen. Police shall be able to track down the stolen article in time.

This paper helped us to understand the need and scope of GPS based systems and related latest technologies in traditional policing methods.

vii) Map Matching Algorithm and Its Application: [7]

This paper gives the general idea of map-matching algorithm thereby discussing few of the standard algorithms along with some experiments and analysis to establish the reliability of these algorithms. The author gives a diagram of the coordinating calculation and a portion of its applications. Guide coordinating calculation depends on the hypothesis of example acknowledgment. The area of the vehicle or truck voyaging ways getting from different GPS contrasts and electronic guide street information of vehicle, and looks for coordinating metric degree. as to lines of the best coordinating metric degree as present vehicles voyaging courses, and afterward discover the street where vehicle runs, and show the ongoing area of vehicle.

The author defines map matching as a procedure that unites the geographical location data (i.e. latitude and longitude) along with an online-map to produce the real-time position of a device.

The author mentions that there has been a wide variety of map-matching algorithms that have been developed in theory since last few years. These different map-matching algorithms have been classified as following on account of the procedures and methods that have been used in the process:

- Geometric
- Topological
- Probabilistic
- artificial intelligence

viii) Mobile Tracking System using Web Application and Android Apps:[8]

The GPS beacons with GSM administrations are accessible in advertise however one needs to purchase these administrations intermittently. Here, creator clarifies how a GPS following framework can be made utilizing web application and portable applications free of cost.

The system designed by the author included of three sections:

- The space fragment
- The control portion
- The client portion

The space section contained an insignificant assemblage of twenty four satellites that sends single course flag that give the nonstop GPS satellite position and time. The Control Segment traces the GPS satellites, moves invigorated navigational data, and keeps up state and position of the satellite star gathering. The client portion incorporates the GPS beneficiary equipment and usages the transmitted information to calculate the customer's three dimensional position and time.

ix) Location Based Services using Android Mobile Operating System: [9]

An engaging use of LBS incorporates observation where moment data is expected to decide whether the individuals being checked are any genuine danger or an off-base objective. We have had the option to make various applications where area based administrations are being utilized. Be that as it may, these applications are constrained to work areas as it were. We have to import them on cell phones. LBS have two significant activities, that is:

1. Acquiring the area of client.
2. Using this data to give a help. Major components of an LBS are:

- LBS Application
- LBS Middleware
- Location Tracking
- GIS Provider
- Location Collection Service

Further, the author lists the uses of LBS and also the advantages and limitations of using the android platform.

x) Location Based Services on Smart Phone through the Android Application: [10]

In this article the authors designed an Android app with three modules,

1. Profile modifier based upon area
2. Location tracing of a person by Friends or Family
3. Nearby Friends alert and reminder.

Security issues are typical in most of the operating systems. However, with Android-based Global Positioning System (GPS) and Locations Based Services (LBS), There's a stark possibility that hackers may be able to trace and follow the movements as well as geographical location of the Android device owner. The author's has adopted a method as a potential solution. Here, the system stores the data of Android applications in an anti-malware providers' cloud.

xi) Position Detection and Tracking System:[11]

In this article the writers structured an android application which could be utilized to find the situation of the loved ones. This application had a ready system to send a SMS to the client when his companions/relatives are close by. Instant message could be imparted to online client. This framework incorporates a versatile customer, a storehouse, a web customer, a guide administration. The portable customer was utilized to discover the area and send SMS to client when his companions or family come around the client's course. This area data could be sent to the server and a similar data could be overseen and seen utilizing the web customer by different clients. As a future work, the creator recommends, the proposed framework can be actualized to refresh the followed position subtleties to the long range interpersonal communication sites.

Figure 4. modules and communication [16]

The proposed system by the author consists of six modules namely:

- Mobile client
- Repository
- Web client.
- Map service.
- Message Alert system for detection of Position of Friends.
- Data sharing center.

xii) Police technology in cities: changes and challenges: [12]

The creator discloses to us how the police frameworks are gradually adjusting the most recent advances like Biometric, Locational checking (GPS following), facial and conduct acknowledgment and so on. Police advances are changing the manner by which urban spots are seen and the circumstances under which residents utilize these spots. As these advancements prolix among urban communities, numerous inquiries stay about the protection effects of these machine frameworks, their impacts on the regular daily existence of urban residents (both the "blameworthy" and the "guiltless"), the legitimate implications of profiling innovations, and the expanding computerization of these machine frameworks. As human administrators are step by step wiped out from progressively self-sufficient frameworks, what befalls the security privileges of people.

xiii) P2P & LBS Technology-Based Mobile Police System Design: [13]

In this article the writer structures a Mobile Police System which utilizes Location Based Services and P2P. This examination paper intends to forestall and diminish wrongdoing by structuring a portable police application framework incorporating office work, early cautioning, exposure and observation. Police dispatch has consistently been a trouble confronting open security specialists.

At present, the principle arrangement is to utilize the GPS position discoverer. GPS position discoverer is muddled in activity and contact by phone is seriously restricting and slacking. The police direction and battle framework consolidates police land data application stage with cell phone programming by means of port association with know the particular situation of cops whenever utilizing the LBS situating innovation.

CHAPTER 3: SYSTEM DEVELOPMENT

System Requirement:

Hardware:

Smart phone with Android OS

GPS module

PC with Intel core i3 (or above)

Software:

Operating System: Android 6 or higher

Browser: Any browser with HTML 5 support (Preferably Google Chrome)

Use Case:

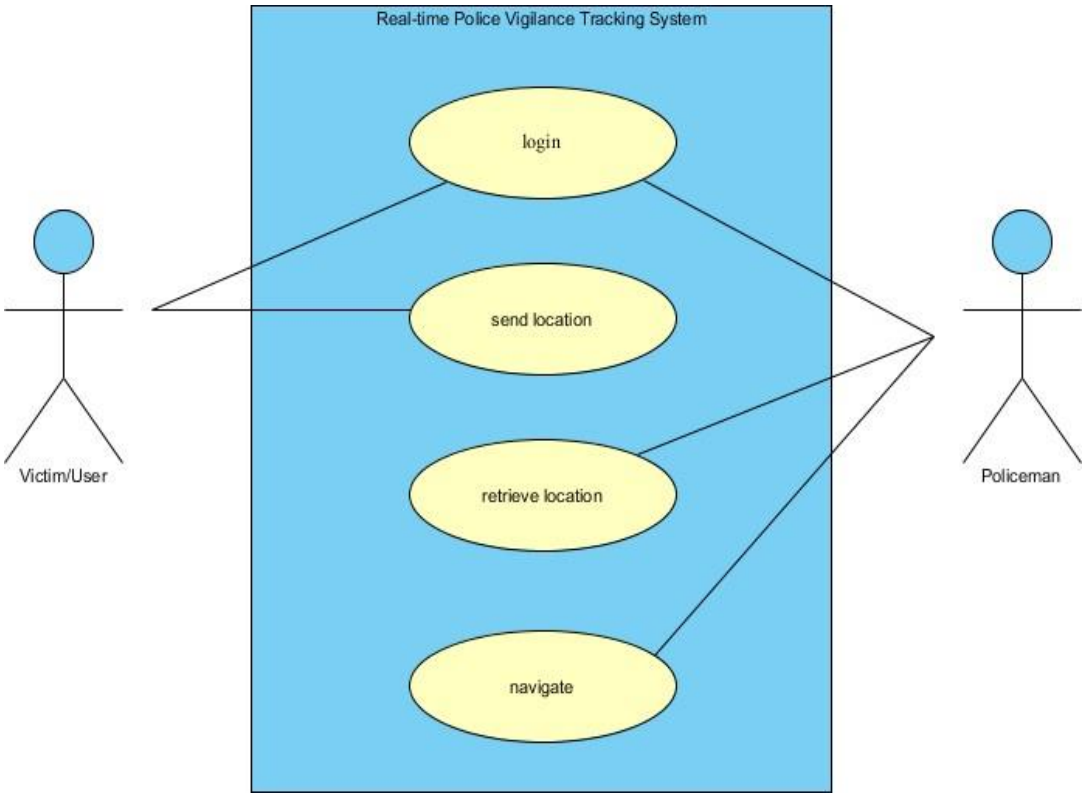

Figure 5. Use case diagram

There are two main actors in our use-case:-

- User/Victim: The user shall have an android app with help distress button. The user will need to press the help button if he/she is in an emergency and the current geographical location of the user will be sent to the policeman.
- Admin/Policeman: The policeman will also have to login and enter their identification no. during the time of registration. Rest, an on-duty policeman shall receive the distress alert which he/she shall accept. Then the location of the victim will be pinpointed on a map on the device of the policeman and will assist him/her to navigate to the crime scene.

Model development:

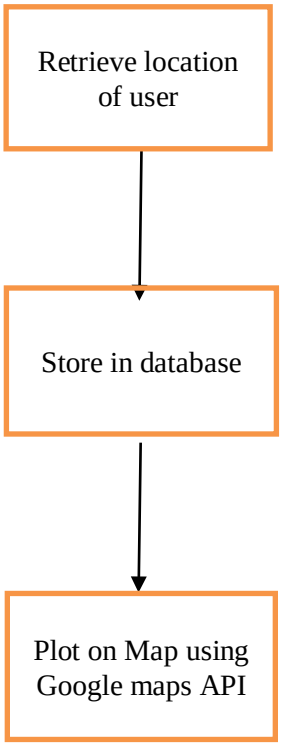

Figure 6. System Design Model

To understand this system design model, we have used a real-time database 'Firebase' by Google and coordinated it with the Google maps utilizing Google Maps API. Mostly we have used the JavaScript and html to program our system as required. A portion of this system is developed using android framework and rest using web-app framework.

In this part we will discuss the different parts of our system and we will explain in detail how each of the portion has been developed, what technologies and frameworks we have used to design these portions and how they've been integrated to our system as a whole to serve the purpose for which the system has been designed.

Keeping in mind our system design model we have utilized the accompanying techniques to plan our framework:

Firebase Real-Time database:

As mentioned earlier, we are utilizing Google's Firebase which is a real-time database to store our data and to further process it and finally utilize in the Map applications.

For this task, Information from GPS sensors of the cell phone gadget is recorded and sent to firebase's real-time database. We have programmed our database in such a way that each time a gadget begins sending information, a node is created in the database, Under this node a new value is created which comprises of the respective latitude and longitude of that very gadget.

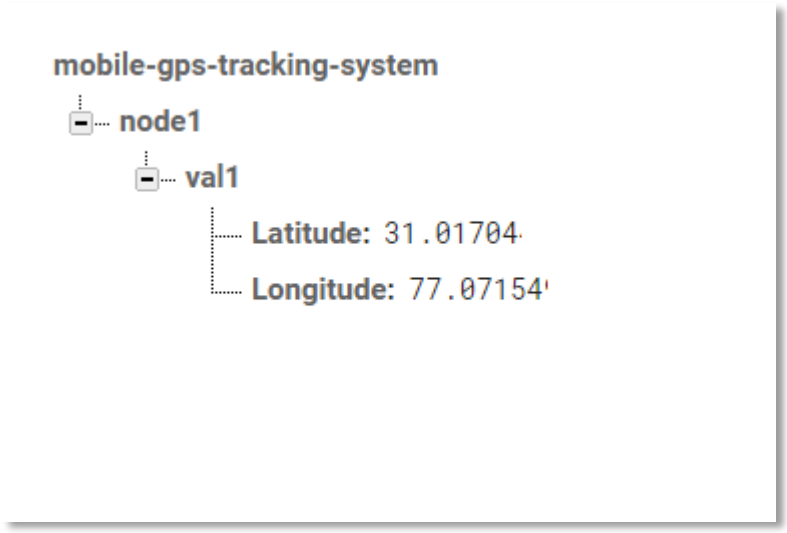

Figure 7. Database Design

When another gadget starts transmitting its geographical data then a new node is created in the database with the value comprising of the latitude and longitude of the new gadget. To ensure the safety of the users, so that this data may not be abused for any other purpose other than the specified one, the nodes from the database shall be permanently deleted from the database after a specified interval. Whereas, the node which contains the geographical data of the admin shall not be deleted and used as a reference point.

The database makes a node as a gadget starts sending its location at a specific timestamp with its present Latitude and Longitude right then and there. This is a real time database in the sense that it continues refreshing its information as indicated by the node occasionally along these lines giving resulting area at those moments. We can get to firebase in our system by giving necessary permissions in our JavaScript code and referencing the ongoing database in content and controlling it as per our need.

Developing Front-End:

Here, Our goal is to develop the UIs that will be visible to the user and to the admin. So, in designing this portion we needed to strictly stick to the user specifications since it will be the end user who shall be operating the system. We kept in mind that the needs of the different stakeholders to the system. Therefore we divided this part into two parts:

- User:

The user will be the victim who is in a desperate need for police help shall have a very simple User Interface with an emergency distress button which clearly visible and accessible. Here, we designed a simple UI on android. We designed a large distress button which redirects the user to a web-page which, after taking the user's permission to access his/her location sends the distress alert to the admin. We designed this webpage using HTML. The geolocation function of JavaScript has been used to retrieve the location of the device in the terms of latitude and longitude. This webpage also shows the geographical data of the user.

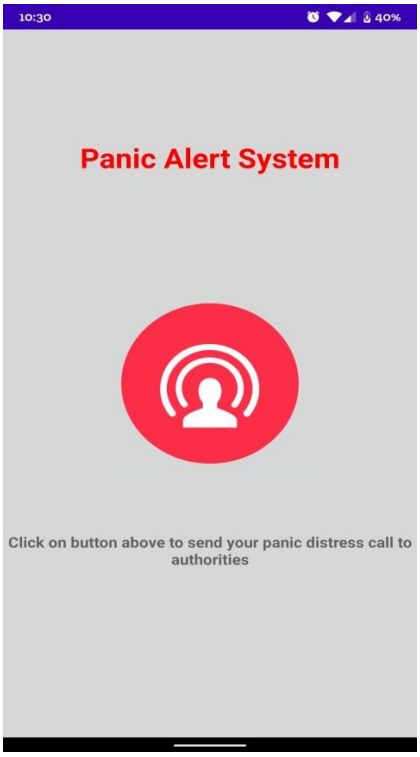

Figure 8. Snapshot of user app

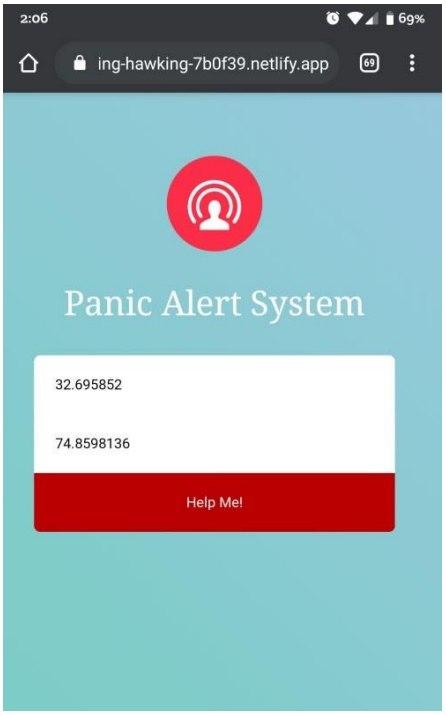

Figure 9. Snapshot of user webpage

- Admin:

  The admin who is going to be the on-duty police personnel shall have a system UI which will alert him about the emergency. Further, as son as the request for the emergency is considered by the admin, the location that has been stored on the database shall now be utilized to track the victim.

  For this purpose we have designed a web-page UI for the admin which we have interfaced th web page with the Google maps using Google maps API. This API has been integrated with the system using the unique API key that Google provides after we register on its Google maps console. Also, to retrieve the location of the user from database, we have integrated this page with the firebase using the API key similarly as mentioned earlier.

  After successfully accomplishing these steps the map finally pinpoints the exact location of the useron the Google map which shows up on the device of the admin.

Plotting Marker on Map:

Next advance in designing our system design model is to plot markers which point the present location that have been retrieved from the Firebase database. For this purpose we use various functions from the Google console to design the map as per our convenience and need. As mentioned earlier we use the API key provide by the Google mps platform to integrate it into our system. Along these lines, we will create a real-time marker plot that will check the gadget's movement. As many nodes will be created in the database, the same number of markers will be plotted on the map showing the respective position of the users on the map

We have utilized different capacities having a place with Google Maps API which can be found in the catalog of Google. In the picture below we show the method we have used to plot the required markers on the map.

```
    var start = new google.maps.LatLng(la1, lo1);
    var end = new google.maps.LatLng(la2, lo2);
     var line = new google.maps.Polyline({
 path: [new google.maps.LatLng(la1, lo1), new google.maps.LatLng(la2, lo2)],
 strokeColor:'#FF0000',
 strokeOpacity: 1.0,
 strokeWeight: 5,
 geodesic: true,
 map: map
 });
var marker1 = new google.maps.Marker({
       position: {lat: la1, lng: lo1},
       map: map,
     });
     var marker2 = new google.maps.Marker({
       position: {lat: la2, lng: lo2},
       map: map,
     });
```

Figure 10. Snapshot of code

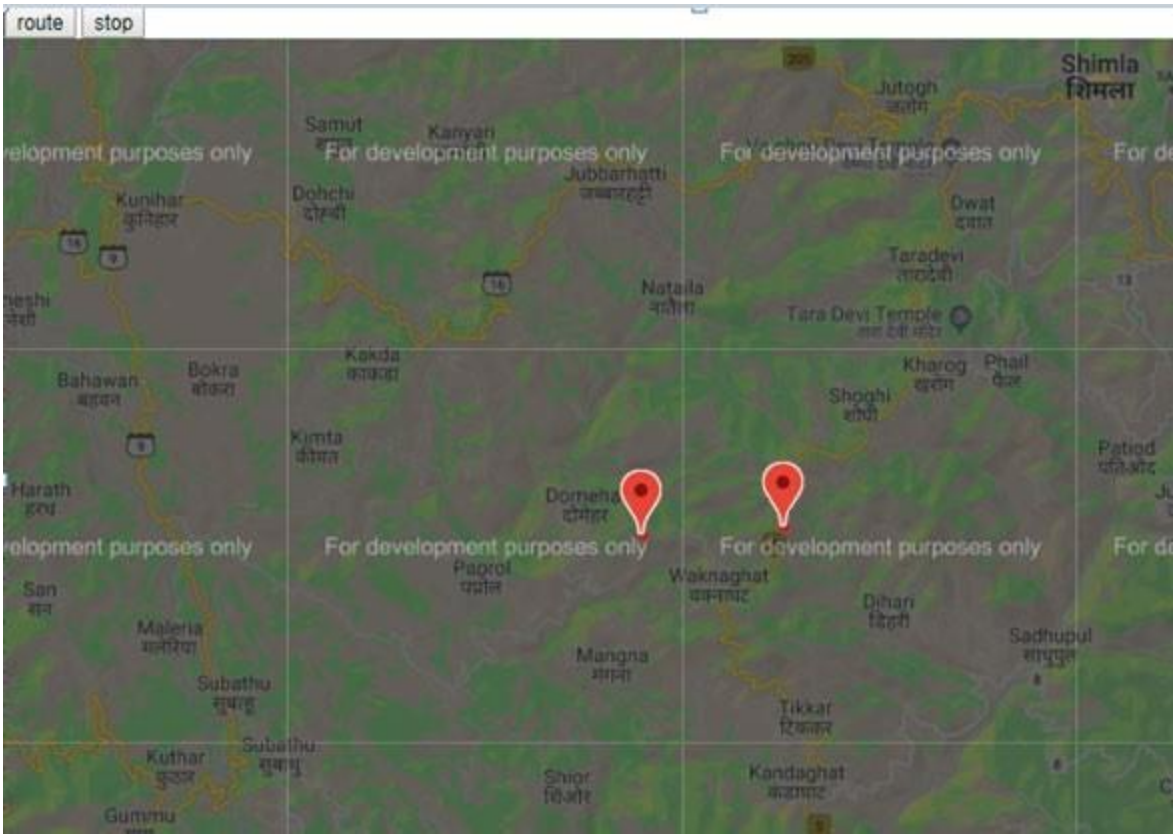

Figure 11. Admin webpage

This is how the two devices at different location is plotted on the map. Of these, one marker is of the admin which is the reference point and stays on the firebase while the other is that of the user which gets deleted after sometime from the database.

CHAPTER 4:

RESULTS AND PERFORMANCE ANALYSIS

Test Plan:

DataSet:

We've gathered the geographical dataset i.e. latitude and longitude at different locations and we have stored it on our real-time firebase database. A screenshot of the dataset from firebase real-time database has been given below:

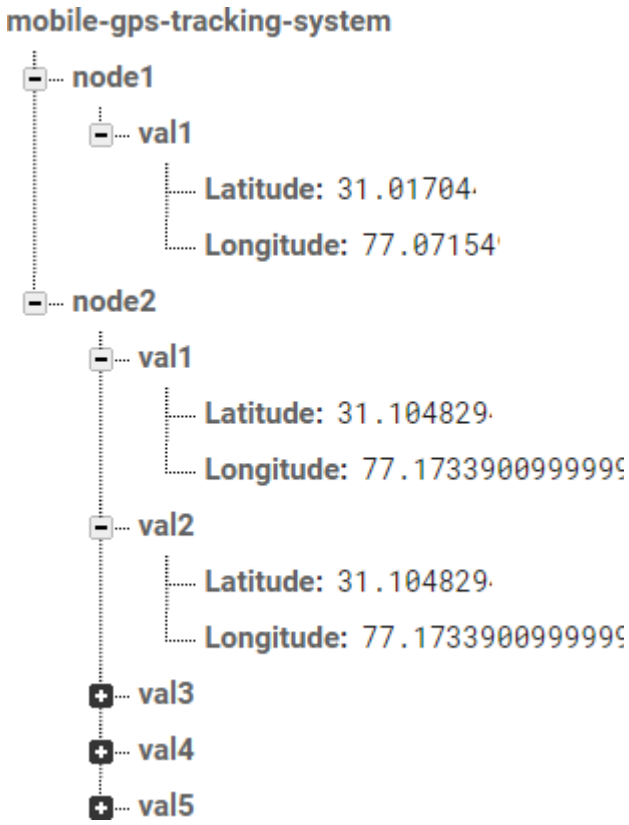

Figure 12. Dataset from database

We have to initially recover module's sensor information to our web-app which is put away in Firebase's real-time database. So as to continue with our goal of the undertaking, we first associate firebase and check if the database stays steady after information update and recovery.

We have utilized Google chrome's console to print the information being recovered from firebase so as to screen it and thus check for and irregularity in information. Given beneath are the photos portraying contents to be imported and group in which information is recovered:

```
<script src="https://www.gstatic.com/firebasejs/6.0.4/firebase-app.js"></script>
<script src="https://www.gstatic.com/firebasejs/3.1.0/firebase-database.js"></script>
```

Figure 13. Snapshot of code (1)

```
var firebaseConfig = {
    apiKey: "AIzaSyACLks6jyuTPPqGyZzK9W8Cjr9p2XkYSS4",
    authDomain: "mobile-gps-tracking-system.firebaseapp.com",
    databaseURL: "https://mobile-gps-tracking-system.firebaseio.com",
    projectId: "mobile-gps-tracking-system",
    storageBucket: "mobile-gps-tracking-system.appspot.com",
    messagingSenderId: "996668198627",
    appId: "1:996668198627:web:639a35540bd295bda23fd6",
    measurementId: "G-FEXYWC2265"
  };
  firebase.initializeApp(firebaseConfig);
```

Figure 14. snapshot of code (2)

Whenever there is an error or any of the nodes misbehaves and causes discontinuous or anomalous data, It can be straightway be checked using the Google console which we can operate by pressing Ctrl+Shift+J. We used this to keep a check on the results and the performance of the database simultaneously.

Below is a picture depicting how firebase data is displayed in Google chrome's console:

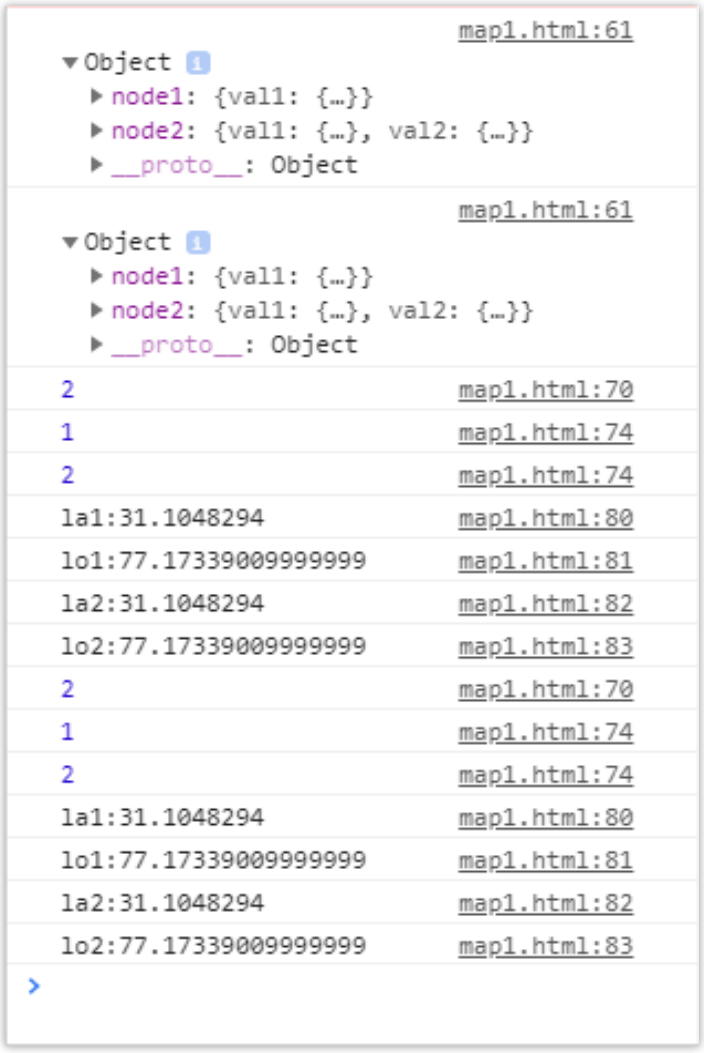

Figure 15. Snapshot of Google chrome console

Web App UI- User:

Here is the basic web page that we initially designed in the testing phase check whether the system is retrieving the geographical location and updating it properly or not .We've included the bar that shows current latitude and longitude of the gadget for the testing stage.

Likewise we've included refresh and stop button for testing stage. At the point when update button is pressed, new nodes are included after explicit timestamp and the stop button prevents the framework from refreshing the qualities. We have tested whether the location is exact at different places and the outcomes were pretty satisfying.

This web page actually proved very helpful for us to keep a regular check on our system's performance and whether the results are continuous or not.

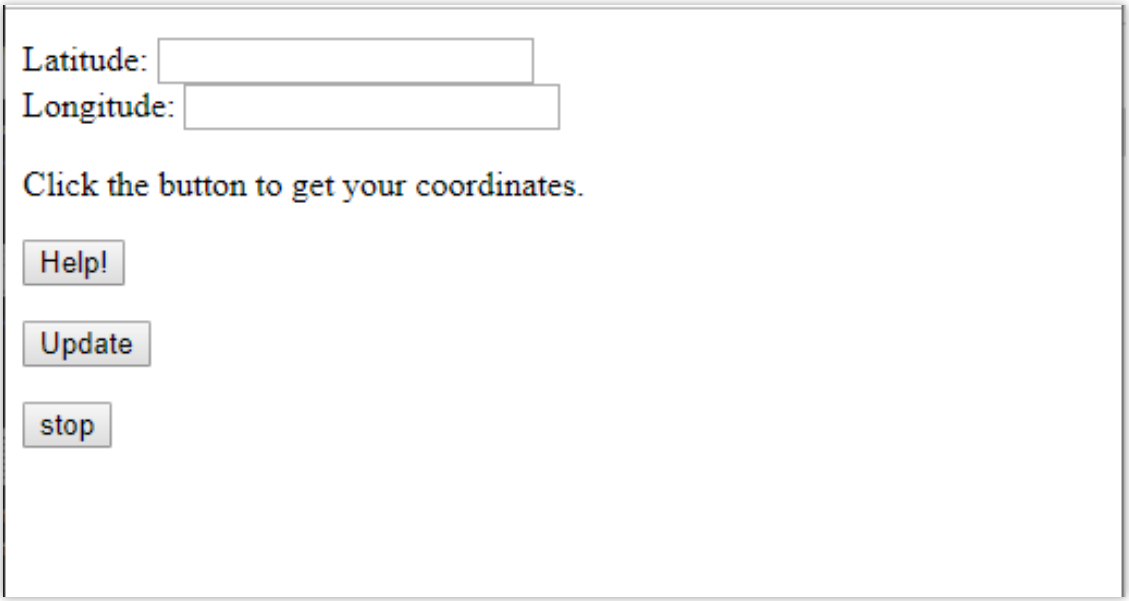

Figure 16. User UI for testing

Web-App UI- Policeman:

This is the part where the marker for the current location of the device is plotted on a map. This required the most testing. Here, when you press the route button, it shows all the present nodes in the database. Test results from the different places that we went to test the accuracy of the system was satisfactory.

We developed the web-app on Android covering all the mentioned APIs and the application was tested using Google Pixel 2 handset and for programming we have used HP laptop PC with Intel core i3 processor. Both of these devices are GPS enabled and make use of Location Based Services

- Android Edition – 10
- Android access authorizations:
    i) android. permission. INTERNET
    ii) android. permission. ACCESS_FINE_LOCATION

In the map below it shows a marker that is showing the current position of the marker at the JUIT at Waknaghat, Solan. This node was introduced to the database from the Parmar Bhawan in the University premises.

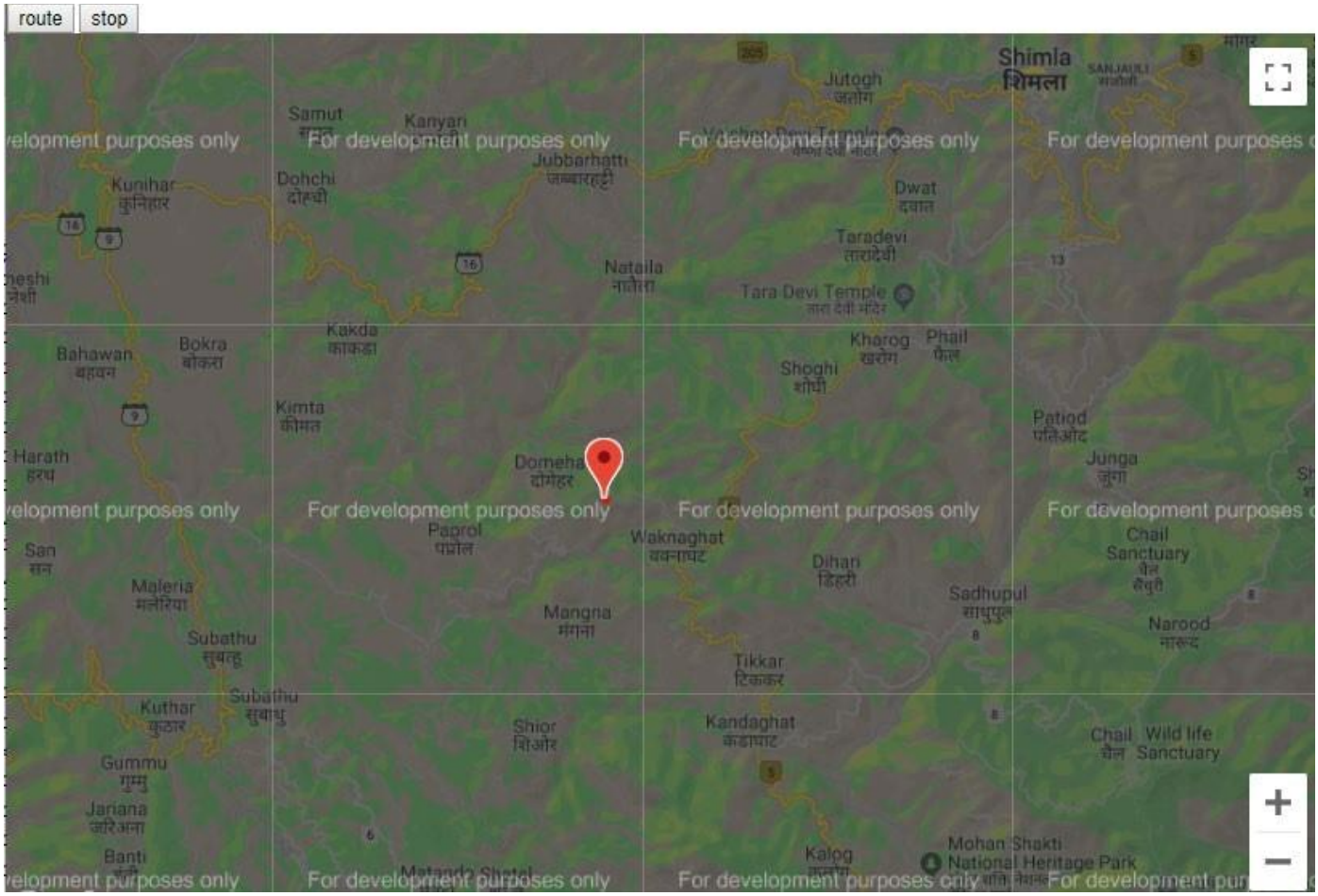

Figure 17. Google maps plot (testing)

This helped us establish the accuracy of the system. We tried getting data from many different locations and compared the location plotted on our map with the actual location using Google maps mobile application.

CHAPTER 5: CONCLUSION

Conclusions:

As, the current GPS gadgets are costly, we are utilizing keen cell phones which nearly everybody claims today. This framework gets the area from satellite and continues refreshing the qualities at standard interims while the qualities are put away on an outside web database, the area of the subject is pinpointed on the guide and the present course is plotted.

The usage of this undertaking shows how the appearance time of the police can be decreased a few times since this framework spares a great deal of time for the police to find and arrive at the injured individual at the most punctual. The area based administrations in the most recent cell phones is essentially precise and by abusing these administrations utilizing our framework we wish to handle the wrongdoing.

The framework planned will be free of cost and won't require any extra gadgets. We have planned an extremely basic User Interface so the clients of the framework which are laymen can undoubtedly utilize the application with no trouble.

Another issue we called attention to before in this paper was the security and protection of the clients since the area of an individual is a private issue and whenever misunderstood into hands can have grave results. Be that as it may, the present android protection arrangement is severe and without the consent of the client the application won't have the option to remove the area of the client. We've played it safe while programming for the code in order to maintain a strategic distance from any escape clauses which may cause spillage of the area information of the client. Important access keys have been utilized to stay away from any such occurring. Rest, we will put the framework to thorough testing utilizing various informational collections to test for and explain any protection concern. Protection of the client is of most extreme need for us.

A few advantages of Real-Time Police Vigilance Tracking System are-

- **Easy to utilize and straightforward UI**: This framework is executed as a web-application which will be additionally coordinated with an android application. The two diverse User Interfaces for client and police officer have been structured just with clear fonts and strong content. We've especially kept in mind the user specifications to make the system more user-friendly.

- **Cost**: Since no additional equipment or programming is required and the framework requires the ordinary determinations of a cell phone, the framework is exceptionally modest. The framework basically utilizes Location Based Services of a cell phone to recover its current geological area utilizing satellites. So, no unnecessary overhead costs are there making the system more feasible for general use as well as specialized use.

- **Web-application supported with all platforms**: All the platforms supporting HTML5 script can run the web-application. All the devices that are GPS enabled with Location based Services can support this system. We've given utilizing various programs a shot diverse android gadgets and the web-application runs easily on all stages

- **Secure**: The framework structured is secure as we have given a ton of consideration towards the security and protection of the client. The geographical information of the client is possibly retrieved only if the client concedes the authorization to do as such. Moreover, the user data is deleted from the database from time to time so that it doesn't end up in wrong hands and misused for in any way.

- **Reliable**: The framework can be depended upon by both the end-clients as it is exceptionally proficient and gives the right geographical information. The adaptability of the web-application to run on all platforms makes it entirely dependable. The client can depend upon the product to share his/her location with the closest cop just by pressing a solitary button.

In spite of the advantages of the Real-time Police Vigilance Tracking System, we concede that it likewise has a few confinements which we wish to chip away at. A portion of the impediments of this framework are recorded underneath:

- **Technology Constraints**: To make Location Based Services chip away at huge scale the mapping of Geographical Information must be increasingly far reaching than it is now. Despite the fact that there are numerous calculations to improve utilize GIS and LBS; it is still needs a great deal of work to be finished. Likewise, there's the limitation of the android gadgets since many devices may not be able to satisfy the specification required to run the system seamlessly.

- **Infrastructure Constraints**: Another huge issue is the absence of the spread of remote system in the country and remote zones. Since, India is a developing nation; the remote innovation here is still in a developing stage. Likewise, another significant issue with framework here is of Network traffic. For this framework to work effectively we have to avoid network blockage no matter what. The LBS need an appropriate web association consistently to contact with the satellites and any discontinuity in web association because of any reason will make this framework quit working.

  Also, still numerous individuals don't utilize smart cell phones and for appropriate capacity of this system the gadgets need to have the most recent specialized particulars.

- **Market disappointment**: Though our system is financially feasible, the incorporation of this framework with standard Police and overall population still appears to be an uncertain occurring. Since LBS have been introduced numerous such frameworks have been proposed yet none could make it to a definitive objective overall of policing. The purpose behind this is the customary policing methods which don’t have a lot of room for technological advancement and legislative restrictions. To make this framework arrive at standard open a great deal of work is as yet required.

- **Technical Dependency:** It is as yet a reality that individuals as a rule don't have confidence in machines as much as others. The individuals should be introduced to many such of such framework so they can build confidence in it. Moreover, such frameworks must be made more transparent; source code should be easily accessible so that people can trust such systems.

  The framework should be significantly more secure since cyber-theft is an extremely delicate issue and if the framework flops because of any explanation and cause any damage to life there will be an overwhelming backfire and can get the framework into lawful issues.

Future Work:

In this section we will discuss the scope for future work on this system. There are still a lot of features that could be added to this system to make it much more accessible by all kinds of people. We wish to add a few highlights to our framework. Below we point out some of the technological changes to software as well as hardware that we have in our mind.

- We wish to incorporate hardware with our framework. A feature could be designed by manipulating the hardware of the android device with the help of which a user could set up a pattern for pressing the power button of the device to activate the android application and send the distress call.

  Such a feature shall especially be useful for blind people who otherwise won't be able to access this system. Not only this many any other hardware features could be added to the system which makes the scope of the expansion in the system unlimited further increasing its accessibility, making it cheaper and more feasible and therefore more acceptable.

- Likewise, we wish to include the Google maps Route highlight to our framework which will assist the cop with locating and arrive at the unfortunate crime-scene quicker. Google maps route will show the briefest courses with least traffic which can prove to be lifesaving.

By subscribing to the premium features of the Google Maps which provide Google Navigation Services, we can add the Navigation to our system which will be even more helpful to the policeman. Google Navigation can show the route to the user and lead him to the destination location effortlessly.

- To make the framework considerably more reliable, AI and Machine Learning which are weeping away the software market, could also be utilized.

  Using Machine Learning we could train a model which shall identify the level of threat to the victim. This way the system could mark the distress alerts as urgent, moderate and trivial. Further these distress alerts shall be prioritized accordingly creating a schedule for the policeman. This shall help the police work efficiently in densely populated metropolitan cities and reach the person in need for urgent police help at the earliest

  Artificial Intelligence could be integrated with the system to make it handier and help reach more people. This will help over the constraints like- less awareness, illiteracy, language barrier etc. This could be a big leap towards trust building.

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APPENDIX

1. Admin Webpage (testing):

```
<!DOCTYPE html>
<html>
<head>
<script src="https://www.gstatic.com/firebasejs/6.0.4/firebase-app.js"></script>
<script src="https://www.gstatic.com/firebasejs/3.1.0/firebase-database.js"></script>
</head>
<body>
<pre id="data"></pre>
<form>
Latitude:
<input type="text" id="text1"><br>
Longitude:
<input type="text" id="text2"><br>
<p>Click the button to get your coordinates.</p>
</form>
<button onclick="getLocation()">Help!</button>
<p id="demo"></p>
<button onclick="up()" >Update</button>
<p id="upd"></p>
<button onclick="stop()">stop</button>
<p id="demon"></p>
<script>
var key1;
  var firebaseConfig = {
  apiKey: "AIzaSyACLks6jyuTPPqGyZzK9W8Cjr9p2XkYSS4",
    authDomain: "mobile-gps-tracking-system.firebaseapp.com",
    databaseURL: "https://mobile-gps-tracking-system.firebaseio.com",
    projectId: "mobile-gps-tracking-system",
    storageBucket: "mobile-gps-tracking-system.appspot.com",
    messagingSenderId: "996668198627",
    appId: "1:996668198627:web:639a35540bd295bda23fd6",
    measurementId: "G-FEXYWC2265"
  };
  firebase.initializeApp(firebaseConfig);
</script>
<script>

function getLocation() {
```

```
  if (navigator.geolocation) {
    navigator.geolocation.getCurrentPosition(showPosition);
  } else {
    x.innerHTML = "Geolocation is not supported by this browser.";
  }
}
function showPosition(position) {
var firebaseRef= firebase.database().ref();
  firebaseRef.once("value")
  .then(function(snapshot) {
var a= position.coords.latitude;
var b= position.coords.longitude;
console.log(a);
console.log(b);
document.getElementById("text1").value = a;
document.getElementById("text2").value = b;
var firebaseRef= firebase.database().ref();
var button1=document.getElementById("demo");
var maxaqi= 0;
  var minaqi= 500;
     var c= Math.floor(Math.random() * (maxaqi - minaqi) + minaqi);
            var o = document.getElementById("update");
   var x= Object.keys(snapshot.val());
  var z= x.length;
  console.log(z);
  key1= firebaseRef.child("node"+[z+1]).getKey();
  console.log(key1);
    var q= snapshot.child(key1).numChildren();
    console.log(q);
    if( q==0){
  firebaseRef.child(key1).child("val1").child("Latitude").set(a);
  firebaseRef.child(key1).child("val1").child("Longitude").set(b);
 // firebaseRef.child(key1).child("val1").child("aqi").set(c);
    }
    else{
    firebaseRef.child(key1).child("val"+[q+1]).child("Latitude").set(a);
    firebaseRef.child(key1).child("val"+[q+1]).child("Longitude").set(b);
 //firebaseRef.child(key1).child("val"+[q+1]).child("aqi").set(c);
    }
});
}
 function up(){
  navigator.geolocation.getCurrentPosition(showPosition);
  function showPosition(position) {
  setInterval( function() {
var f= key1;
console.log(f);
```

```
var firebaseRef= firebase.database().ref();
  firebaseRef.once("value")
  .then(function(snapshot) {
var a= position.coords.latitude;
var b= position.coords.longitude;
console.log(a);
console.log(b);
document.getElementById("text1").value = a;
document.getElementById("text2").value = b;
var firebaseRef= firebase.database().ref();
var button1=document.getElementById("demo");
var update= document.getElementById("update");
var maxaqi= 0;
  var minaqi= 500;
     var c= Math.floor(Math.random() * (maxaqi - minaqi) + minaqi);
             var o = document.getElementById("update");
   var x= Object.keys(snapshot.val());
  var z= x.length;
  console.log(z);
  var f= key1;
  var q= snapshot.child(f).numChildren();
    console.log(q);
            firebaseRef.child(f).child("val"+[q+1]).child("Latitude").set(a);
    firebaseRef.child(f).child("val"+[q+1]).child("Longitude").set(b);
 // firebaseRef.child(f).child("val"+[q+1]).child("aqi").set(c);
  });
  }, 5000)
  }
  }


function stop(){
location.href=location.href;
}
</script>
</body>
</html>
```

2. Map for testing:

```
<html>
<head>
<title> Realtime mapping </title>
<script src="https://www.gstatic.com/firebasejs/6.0.4/firebase-app.js"></script>
<script src="https://www.gstatic.com/firebasejs/3.1.0/firebase-database.js"></script>
</head>
<script async defer
src="https://maps.googleapis.com/maps/api/js?key=AIzaSyDG8LkrCx-
6lgRt3f3_HcU3i9k4FAg_E0g&callback=mapLocation">
</script>
<style>
html, body, #map-canvas {
   height: 100%;
   width: 100%;
   margin:  0px;
   padding: 0px;
}
</style>
</head>
<body>
<input type="button" id="routebtn" value="route" />
<input type="button" id="stp" value="stop" onclick="stop()" />
<div id="map-canvas"></div>
<script>
var firebaseConfig = {
   apiKey: "AIzaSyACLks6jyuTPPqGyZzK9W8Cjr9p2XkYSS4",
   authDomain: "mobile-gps-tracking-system.firebaseapp.com",
   databaseURL: "https://mobile-gps-tracking-system.firebaseio.com",
   projectId: "mobile-gps-tracking-system",
   storageBucket: "mobile-gps-tracking-system.appspot.com",
   messagingSenderId: "996668198627",
   appId: "1:996668198627:web:639a35540bd295bda23fd6",
   measurementId: "G-FEXYWC2265"
 };
 firebase.initializeApp(firebaseConfig);
</script>
<script>
 function mapLocation() {

   var directionsDisplay;
   var directionsService = new google.maps.DirectionsService();
   var map;

   function initialize() {
      directionsDisplay = new google.maps.DirectionsRenderer();
```

```
        var chicago = new google.maps.LatLng(28.620064, 77.207739);
        var mapOptions = {
            zoom: 7,
            center: chicago
        };
        map = new google.maps.Map(document.getElementById('map-canvas'), mapOptions);
        directionsDisplay.setMap(map);
        google.maps.event.addDomListener(document.getElementById('routebtn'), 'click', calcRoute);
    }

    function calcRoute() {
     // setInterval(function(){
  routebtn.click();
    var firebaseRef= firebase.database().ref();
var a= firebaseRef.child("Latitude");
firebaseRef.on("value", function(snapshot) {
   console.log(snapshot.val());
}, function (error) {
   console.log("Error: " + error.code);
});
firebaseRef.once("value")
  .then(function(snapshot) {
  var x= Object.keys(snapshot.val());
  var z= x.length;
 // console.log(x);
  console.log(z);

 for( var u =1; u<=z; u++){
       var q= snapshot.child("node"+[u]).numChildren();
    console.log(q);
    for(var a=1; a<=q-1; a++){
    var la1= snapshot.child("node"+[u]).child("val"+[a]).child("Latitude").val();
    var lo1= snapshot.child("node"+[u]).child("val"+[a]).child("Longitude").val();
    var la2= snapshot.child("node"+[u]).child("val"+[a+1]).child("Latitude").val();
    var lo2= snapshot.child("node"+[u]).child("val"+[a+1]).child("Longitude").val();
 console.log("la"+[a]+":"+la1);
 console.log("lo"+[a]+":"+lo1);
console.log("la"+[a+1]+":"+la2);
 console.log("lo"+[a+1]+":"+lo2);
/*var aqi1= snapshot.child("node"+[u]).child("val"+[a]).child("aqi").val();

var aqi2= snapshot.child("node"+[u]).child("val"+[a+1]).child("aqi").val();
var res= aqi1.toString();
var res1= aqi2.toString();
var l= Math.abs((aqi1+aqi2)/2);
if(l<=100)
{
```

```
var b= "#4CEE06";
}
else if( l> 100 && l<= 250){
var b= "#FBFF00" ;
}
else if( l>250 && l<=300){
var b= "#FFBD00" ;
}
else if(l>300 && l<=400){
var b= "#FD3407" ;
}
else{
var b= "#A11D00" ;
}
*/

        var start = new google.maps.LatLng(la1, lo1);
        var end = new google.maps.LatLng(la2, lo2);
        var line = new google.maps.Polyline({
    path: [new google.maps.LatLng(la1, lo1), new google.maps.LatLng(la2, lo2)],
    strokeColor:'#FF0000',
    strokeOpacity: 1.0,
    strokeWeight: 5,
    geodesic: true,
    map: map
    });

   var marker1 = new google.maps.Marker({
          position: {lat: la1, lng: lo1},
          map: map,
         // title: 'Aqi:'+res
        });
        var marker2 = new google.maps.Marker({
          position: {lat: la2, lng: lo2},
          map: map,
         // title: 'Aqi:'+res1
        });

       /* var bounds = new google.maps.LatLngBounds();
        bounds.extend(start);
        bounds.extend(end);
        map.fitBounds(bounds);
        var request = {
            origin: start,
            destination: end,
            travelMode: google.maps.TravelMode.DRIVING
        };
```

```
        directionsService.route(request, function (response, status) {
            if (status == google.maps.DirectionsStatus.OK) {
                directionsDisplay.setDirections(response);
                directionsDisplay.setMap(map);
            } else {
                alert("Directions Request from " + start.toUrlValue(6) + " to " + end.toUrlValue(6) + " failed: " +
status);
            }
        });
        */

        }
        }
        });
    // }, 30000)

    }

    google.maps.event.addDomListener(window, 'load', initialize);
}
mapLocation();
function stop(){
document.location.reload(true);
}
</script>
</body>
</html>
```

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